	Found.	Corresponding angles in Atacamite.
1 1 1, 1 0 0	= 63° 48′	63° 20′
1 1 1, 1 1 0	= 36 27	36 18
1 0 0, 1 1 0	= 56 35	56 10
1 1 0, $1\bar{1}0$	= 66 50	67 40
1 0 1, 1 0 0	= 52 50	52 50
1 0 1, 1 0 1	= 74 20	74 20

Seen in polarized light through 1 0 0, the normal to 1 0 0 appears to be a bisectrix, and the plane of the optic axes is parallel to the edge 1 1 0, 1 0 0; and the crystal, as seen through 1 0 0, is negative.

It is dichroic, exhibiting—

c, = plane of polarization parallel to 0 0 1, grass-green.

b, = plane of polarization parallel to 0 1 0, more yellowish green.

There were but a very few of these minute, in fact microscopic crystals; but two of them I dissolved in nitric acid on a watch-glass, and tested them with nitrate of silver in the field of the microscope. A white cloud was at once struck in the solution, which, while refusing to dissolve in nitric acid, readily yielded to the solvent action of ammonia. This mineral then is Atacamite, as is confirmed by its apple-green streak. Since that time a mine in St. Just has produced this mineral, and I have from Mr. Talling a specimen from there which contains sulphate as well as chloride of copper. I hope soon to have the opportunity of effecting its analysis from purer specimens than such as have as yet been raised; for these consist of an intimate mixture, in which Atacamite, indeed, seems to be the preponderating ingredient, but in which, perhaps, Langite and Brochantite will prove also to be present.

"On the Rate of Passage of Crystalloids into and out of the Vascular and Non-vascular Textures of the Body." By Henry Bence Jones, A.M., M.D., F.R.S. Received April 26, 1865*.

It occurred to me that possibly, by means of the spectrum, I might trace the rate of passage of medicines into the vascular and non-vascular textures, and prove their presence, and determine the time during which they remain in action in some of the tissues far more accurately than had yet been done.

I was fortunate enough to obtain the assistance of Dr. A. Dupré, who had already published a paper in the Philosophical Magazine on the presence of lithium and strontium in the waters of London; and I am greatly indebted to him for carrying out all the suggestions which I thought requisite for proving how soon the salts of lithia pass into the different vascular and non-vascular textures of animals and of man, and how quickly

* Read May 4, 1865; see Abstract, p. 220.

these salts again pass out and cease to be detectable in the different parts of the body.

I shall divide this paper into five sections :—

1. On the method of analysis, and its delicacy.
2. Experiments on animals to which salts of lithium were given, upon the rate of their passage into the textures.
3. On the rate of the passage of lithia-salts out of the textures.
4. On experiments on healthy persons, and on cases of cataract.
5. On the presence of lithium in liquid and solid food.

1. *On the Method of Analysis, and its delicacy.*

Three methods of preparing the substance to be analyzed were followed, according as much or little lithia was present.

When plenty of lithia was present, it was immediately detected in the spectrum by simply touching the substance containing lithia with a red-hot platinum wire. In the case of liquids, a portion of a drop was taken up on the end of the wire, and it was then put into the gas-flame.

If no lithia was thus detectable, a larger or smaller portion of the substance was extracted by distilled water twice or thrice, and the liquid was evaporated to dryness, and the residue was then tested.

If very little lithia was present, it was necessary to incinerate a larger or smaller portion of the substance, and to treat the ash with sulphuric acid, to exhaust the resulting sulphates with absolute alcohol and evaporate the alcohol extract to dryness, and to test the residue for lithia.

Kirchhoff and Bunsen state that less than $\frac{9}{1,000,000}$ of a milligramme of carbonate of lithia = to about $\frac{1}{8,000,000}$ of a grain can be detected by the spectrum analysis.

To determine the delicacy of the test for the chloride of lithium, the following experiment was made :—One grain of chloride of lithium was dissolved in one litre of water. Of this solution 100 cub. centims. were taken and again diluted to one litre, this latter solution containing 0·1 grain of chloride of lithium to the litre.

When further diluted to five times its bulk, the lithium reaction was still seen faintly on a wire taking up 0·06 grain of solution. The line is most distinctly visible in the evening, in a somewhat dark room.

This dilution is equal to 0·1 grain of chloride of lithium in 5 litres of water, or 1 grain in 50 litres. 1 litre = 15,440 grains, or 50 litres = 772,000 grains. In 0·06 grain of this solution there are therefore 0·00000008 grain chloride of lithium, or about $\frac{1}{12,000,000}$th of a grain of chloride of lithium. This contains only $\frac{1}{6}$ part of lithium, so that the $\frac{1}{72,000,000}$th of a grain of metallic lithium, when pure, gives the spectrum reaction.

When the chloride of lithium was dissolved in urine, the test was from twice to six times less delicate than in distilled water.

2. *Experiments on animals to which salts of lithium were given, upon the rate of the passage into the textures.*

Experiment 1. Two guinea-pigs were fed for several days on the same food. One was killed, and the urine, the nails, hair, blood, bones, muscles, nerves, cornea, and crystalline lens were examined by the spectrum, and no trace of lithium was found anywhere. The other was given half a grain of chloride of lithium for seven days, and for two days one grain. It was then killed, and the lithium was found everywhere, even in the cornea, crystalline lens, hair, and toe-nails. In these it was more distinctly present than anywhere else, so that it probably came from the urine.

Experiment 2. Another guinea-pig, fed on the same food as the first two, was given only half a grain of chloride of lithium for three days. The third morning the lithium was detectable, by analysis, in the hair; the fourth day it was killed, and the lithium was found everywhere, as in the last instance.

Experiment 3. Another, after the hair and nails had been examined for four days and no lithium found, was given three grains of chloride of lithium. In two hours and a half lithium was detected in the hair of the belly, though in six hours none was found in the hair of the back; much more was then in the hair of the belly. In twenty-six hours it was killed. Lithium was found everywhere,—both in the outer and inner part of the lens very distinctly, and in the cartilage of hip- and knee-joints. The spleen and liver seemed to have less lithium than the vitreous and aqueous humour and the lens.

Experiment 4. A guinea-pig was given three grains of chloride of lithium, and in twenty-four hours it was killed. Lithium was found in the cartilage of the hip- and knee-joints, in the centre of the lens, in the nails, and in the outer moisture of the eye.

Experiment 5. To another, the hair of which gave no trace of lithium, were given three grains of chloride of lithium, and it was killed in eight hours; as usual, lithium was found in all the organs—by far the most in the kidneys. Little was found in the blood. It was quite evident in the cartilage of the hip-joint, and very distinct in the outer layer of the crystalline lens, but none at all could be found in the centre of the lens. Both lenses were examined more than six different times with the same result.

Experiment 6. In a guinea-pig, much younger than the last, which was killed eight hours after three grains of chloride of lithium, the whole lens was penetrated,—the smallest particle, even one-twentieth the size of a pin's-head, taken from each part of the lens, showing the lithium distinctly. The whole lens of another pig that had taken no lithium was burnt, and did not show the slightest trace of lithium.

Experiment 7. Another guinea-pig was given three grains of chloride of lithium, and it was killed in four hours. Lithium was found in the fibrin, serum, and corpuscles of the blood, in the cartilage of the hip-joint, and in

the lens, even in its most central part. There was scarcely any difference between the inner and outer part. The vitreous and aqueous humours showed much more evidence of lithium than the lens itself did.

Experiment 8. A guinea-pig, the urine of which gave no trace of lithium, had three grains of chloride of lithium, and was killed in two and a half hours. The lithium was found in the cartilage of the hip-joint distinctly but faintly. The blood showed the lithium very distinctly, much more so than in any of the previous experiments. The outer portion of the lens showed lithium, though but slightly. The inner portions of the lens showed more. The vitreous and aqueous humours showed lithium very distinctly.

Experiment 9. A large guinea-pig was given three grains of chloride of lithium, and it was killed in an hour. Lithium was found in the blood, urine, and nails very distinctly; in the cartilage of the hip- and knee-joints very faintly; in the vitreous and aqueous humours of the eye very distinctly. No lithium was found in the lens, not even when half the lens was taken for a single experiment. The stomach contained food.

Experiment 10. Another guinea-pig was killed an hour after the same dose. The lithium was found strongly in the blood, bile, liver, and kidney. Traces occurred in the brain and in the cartilage of the hip-joint. It was present distinctly in the humours of the eye and in the lens. The difference between the inner and outer part of the lens was very marked. The second eye was not examined for more than fourteen hours after the first eye. After this time the centre of the lens contained as much lithium as the outer part did. The stomach contained water.

Experiment 11. A young guinea-pig, fasting, was given three grains of chloride of lithium, and thirty-two minutes afterwards it was killed. Lithium showed faintly in the cartilage of the hip-joint; very distinctly in the humours of the eye; distinctly in the outer part of the lens, very faintly in the inner part; nearly the whole of the inner part had to be burnt to give the appearance. Lithium was very distinct in the blood, and remarkably so in the nails.

Experiment 12. Another young guinea-pig, fed in the same way, and bought at the same place as the two former, was killed without taking any lithia. No lithium was found anywhere. The whole of the spleen, one kidney, and one lens were incinerated, and each ash was used for a single experiment, and in no instance was lithium found. There was no lithium in the cartilage of the hip-joint, nor in the blood, nor in the nails.

Experiment 13. A very young and small guinea-pig that had been kept fasting for thirty-six hours, was given three grains of chloride of lithium, and it was killed in half an hour, the urine having been previously examined, and no lithium found in it. Very much lithium was found in the blood and in the urine; very slight traces in the cartilage and in the brain. The lens showed no lithium when incinerated entire, but the aqueous extract of the lens showed minute traces of lithium.

Experiment 14. An old guinea-pig, also fasting for about thirty-six hours, was given the same quantity of chloride of lithium, and was also killed in half an hour. No lithium could be detected before the dose in the urine, nor in the toe-nail of one leg. After taking the lithium, the animal was wrapped up in a cloth, the leg only being left out, to prevent it from licking the toe; after death, the nails of this leg showed that some lithium was there. The sciatic nerve showed traces of lithium. The cartilage of the hip-joint, when touched with red-hot wire, showed no lithium, but scrapings from the surface showed traces of lithium. The humours of the eye showed traces of lithium, but the lens showed no lithium even in the watery extract. The brain showed only exceedingly faint traces of lithium. The stomach was almost completely empty.

Experiment 15. A guinea-pig was kept fasting for twenty-four hours; it was then given three grains of chloride of lithium, and it was killed in a quarter of an hour. Lithium was found in the bile, liver, kidney, and blood very distinctly; very faintly in the brain and in the cartilage of the hip-joint, and in the humours of the eye. None was found in the lens. The stomach contained only some water, no solid food.

Experiment 16. Three fresh guinea-pigs were taken, one was killed without taking any lithium. The urine showed no lithium in one drop, but the ash of the urine showed traces of lithium. No lithium could be detected in any of the organs, not even by treating the ash of the kidney with sulphuric acid and alcohol.

The two remaining animals were each given one quarter of a grain of chloride of lithium.

The first was killed in five and a quarter hours afterwards. All the organs, except the lens of the eye, showed lithium by simply touching them with the red-hot wire. The urine and the bile showed the lithium very distinctly. The blood showed lithium faintly. The vitreous and aqueous humours showed traces of lithium. An aqueous extract of the lens showed no lithium. The animal was a large and old one, and the stomach was nearly empty.

The second was killed twenty-four hours after one quarter of a grain.

None of the organs showed any lithium by simply touching them with a red-hot wire. The ash of the kidney showed traces of lithium, and so did the ash of part of the liver. No lithium could be detected either in the vitreous and aqueous humour or in the lens; the urine and the bile showed lithium in one drop, but only faintly. Possibly the lithium had not been absorbed in this case. The state of the stomach, as regards food, was not recorded.

It follows from these experiments, that when no lithium is taken no lithium can be found in the different textures, but that even in a quarter of an hour three grains of chloride of lithium given on an empty stomach may diffuse into the cartilage of the hip-joint and into the aqueous humour of the eye. In very young and very small guinea-pigs the same

quantity of lithium in thirty or thirty-two minutes may give traces of lithium in the lens; but in an old animal in this time it will have got no further than the aqueous humour. If the stomach be empty, in an hour the lithium may be very evident in the outer part of the lens, and very faintly in the inner part; but if the stomach be full of food, the lithium does not in an hour reach the lens. Even in two hours and a half lithium may be more marked in the outer than in the inner part of the lens. In four hours the lithium may be in every part of the lens, but less evidence of its presence will be obtained there than from the humours of the eye. In eight hours even, the centre of the lens may show less than the outer part. In twenty-six hours the diffusion had taken place equally through every part of the lens. Even one quarter of a grain in twenty-four hours showed lithium everywhere except in the lens.

Experiment 17. To endeavour to determine the different rate of absorption and excretion in young and old animals, four guinea-pigs were taken; two were young, and two were old. The four, after fasting for fifteen hours, were each given two grains of chloride of lithium. Two of them, one young and one old, were killed in six hours.

The young animal showed lithium distinctly in the outer and inner part of the lens, and also in the cartilage of the hip-joint, when touched with a red-hot wire. The stomach was about half full of food.

The old one showed lithium distinctly in the outer part of the lens, but scarcely the faintest trace in the inner part. The cartilage of the hip-joint showed lithium quite as distinctly as the cartilage of the young pig.

The other two guinea-pigs were kept. After forty-eight hours, the urine of both showed lithium very distinctly in one drop. Six days afterwards, the urine of the young animal still showed lithium faintly in each drop. The urine of the old one found in the bladder after its death showed lithium faintly in each drop.

Both were killed on the sixth day, and no lithium could be detected in the alcoholic extracts of the kidneys, livers, or lenses of either.

A short series of experiments were made with the view of determining the rate at which the salts of lithium diffuse into the textures when the lithium is injected into the skin instead of passing through the stomach.

Three grains of chloride of lithium in solution were injected into the skin of the back of the neck of a guinea-pig, and the animal was killed in twenty-four minutes.

The urine, bile, kidney, and liver showed lithium very distinctly. The cartilage of the hip-joint showed lithium distinctly when touched with a red-hot wire. The aqueous humour showed lithium very distinctly, but the lens, when washed, showed only a very minute trace of lithium when the entire lens was taken at one time on the wire. The toe-nails showed lithium very distinctly.

Another had three grains injected under the skin of the neck, and it was killed in ten minutes.

The humours of the eye showed lithium distinctly, but the aqueous humour showed decidedly more than the vitreous humour. The incinerated aqueous extract of the lenses showed lithium very faintly. The large nerves of the leg also showed lithium very faintly.

Another guinea-pig had a grain and a half of chloride of lithium injected under the skin of the neck, and in five minutes it was killed. The aqueous humour showed lithium distinctly. The vitreous humour showed none. The blood and bile showed lithium very distinctly. The kidney and urine showed lithium faintly, and the liver very faintly.

In another pig three grains of chloride of lithium were injected into the skin of the neck, and the animal was killed in four minutes.

The blood and the bile showed lithium very distinctly; the blood showed it rather more than the bile. The bladder contained only a few drops of urine, which showed lithium distinctly. The kidney showed lithium fairly well. The liver showed the lithium only very faintly, and in some parts not at all.

The aqueous humour showed lithium distinctly. The vitreous humour showed no lithium.

So that, when injected under the skin,

3 grains in twenty-four minutes gave lithium in the lens and everywhere.

3 grains in ten minutes gave lithium in the lens and everywhere.

1½ grain in five minutes gave lithium in the aqueous humour and in the bile.

3 grains in four minutes gave lithium in the aqueous humour and in the bile.

3. *Experiments on the Rate of Passage of the Lithium out of the Textures.*

Experiment 18. Five guinea-pigs were given two grains of chloride of lithium each. They were killed at different periods; the first in six hours. The smallest particle of the lens showed the lithium very distinctly; a decided difference, however, was detectable between the inner and the outer part. The cartilage of the hip-joint showed lithium very distinctly when touched with the red-hot wire. All the organs and the blood showed lithium very abundantly. The stomach contained very little solid food, but was half full of liquid. The second and third were killed in twenty-four hours. The lenses of both showed the lithium very distinctly; no difference was perceptible between the inner and the outer part. The cartilage of the hip-joint showed no lithium when touched with the red-hot wire; but a small portion taken off the surface showed lithium distinctly.

The fourth guinea-pig was killed in forty-eight hours. The lens showed

lithium very distinctly. A small piece taken from the cartilage of the hip-joint showed only traces of lithium.

The fifth was killed in ninety-six hours. The lens showed no lithium even when a considerable proportion of it was taken for one experiment. The aqueous extract of half one lens showed no lithium. A small portion of the cartilage of the hip-joint showed no lithium. The urine showed lithium very distinctly even in one drop.

Experiment 19. Six fresh guinea-pigs were taken. The first was killed and examined, having had no lithium. The two lenses, incinerated and treated with sulphuric acid and alcohol, showed no lithium. The ash of the kidney showed no lithium directly, but when treated with sulphuric acid and alcohol, showed a distinct trace of lithium.

The five others were given each one grain of chloride of lithium.

The first was killed five and a half hours after the dose. The cartilage of the hip-joint showed lithium faintly when merely touched with a red-hot wire. The lens showed lithium distinctly in the outer part, scarcely a trace in the inner part. The vitreous and aqueous humours showed lithium very distinctly. The stomach was quite full.

The second was killed twenty-four and a half hours after the lithium was taken. The cartilage of the hip-joint showed no lithium even in a small particle scraped off the surface. The lens still showed lithium distinctly, though less so than in the first; no difference was perceptible between the inner and the outer portion.

The third was killed in forty-eight hours. The lens showed no lithium in a small particle taken on a loop of the wire. The aqueous extract of the lens showed only faint traces of lithium. The urine showed lithium very distinctly in a single drop.

The fourth was killed in seventy-two and a half hours. The lens showed no lithium when the ash was treated with sulphuric acid and alcohol. The ash of the kidney showed no lithium directly, but when treated with sulphuric acid and alcohol, showed traces of lithium. The urine still showed lithium distinctly in one drop.

The fifth guinea-pig: on the seventh day after the dose, the urine showed lithium in one drop; ninth day, still faint traces of lithium in the urine; eleventh day, urine directly shows no lithium, but the ash still shows faint traces; thirteenth day, ash of urine shows no lithium, but alcoholic extract shows lithium distinctly; fourteenth day the same; sixteenth day the same; thirty-sixth day, when killed, no lithium could be detected in the bones, nerves, lens, or vitreous or aqueous humours, nor in the urine, kidney, or liver.

Experiment 20. Two guinea-pigs, in the urine of which no lithium could be detected, were given each half a grain of chloride of lithium.

In three hours and fifty minutes afterwards one was killed. The cartilage of the hip-joint showed no lithium when simply touched with a red-

hot wire. Scrapings from the surface of the cartilage showed faint traces of lithium. The sciatic nerve, humours of the eye, and the brain showed faint traces. The muscles of the thigh showed the lithium much more distinctly than the sciatic nerve. The lens showed lithium very distinctly in the aqueous extract, but not otherwise. The blood and bile were very rich in lithium. The stomach was moderately full of food.

The other animal, which was given half a grain, was kept until the lithium ceased to appear in the urine.

Fourth day. Lithium distinctly in the urine.

Tenth day. Urine showed exceedingly minute traces of lithium.

Eleventh day. Still traces.

Thirteenth day. Urine shows no lithium in the quantity adhering to the wire.

Fourteenth day. Still lithium in the alcoholic extract.

Twenty-seventh day. Still traces of lithium.

Thirtieth day. The animal was found dead.

The ash of the urine found in the bladder (about a quarter of an ounce) showed no lithium. The alcoholic extract of the ash showed lithium faintly. The alcoholic extract of the ash of one kidney showed no lithium. And the alcoholic extract of the two lenses showed no lithium.

Experiment 21. Two guinea-pigs, the urine of which contained no lithium, were each given one quarter of a grain of chloride of lithium.

One was killed in four hours and thirty-five minutes. Lithium was found very faintly in the spleen, very distinctly in the blood, in the urine, and in the bile. Faintly in the sciatic nerve and in the brain. Very faintly in the scrapings of the cartilage. Pretty distinctly in the vitreous and aqueous humours, but very faintly in the aqueous extract of the lens. The stomach was moderately full.

The other was kept until the lithium ceased to appear in the urine.

Second day. Lithium very distinctly.

Fourth day. Minute traces of lithium.

Sixth day. A drop or two of urine shows no lithium, but on evaporating and incinerating one-twelfth of an ounce, the ash shows lithium very distinctly.

Seventh day. Lithium still distinct in the ash.

Eighth day. Still in the ash.

Tenth day. Ash of urine shows only the merest trace.

Eleventh day. Ash of urine shows no lithium; but when treated with sulphuric acid and alcohol, lithium is still distinct.

Thirteenth day. Still lithium in one quarter of an ounce.

Fourteenth day. Alcoholic extract from one-eighth of an ounce shows no lithium.

Sixteenth day. The animal was killed. The fluids and organs were incinerated, the ash treated with sulphuric acid, excess of acid driven off

and the dry residue extracted with absolute alcohol, alcoholic extract evaporated, and dry residue tested. The two lenses gave extremely feeble traces of lithium. One-eighth of an ounce of urine and bile gave traces of lithium. Ninety grains of liver gave traces. One quarter of an ounce of blood gave no lithium. An entire kidney, weighing ninety grains, distinctly contained lithium.

Experiment 22. Two guinea-pigs, the hair and nails of which showed no lithium, were given each three grains of chloride of lithium.

In the first, in two hours no lithium was in the hair. In four hours lithium was in the hair of the belly, but scarcely perceptible in the hair of the head. In twenty-four hours it was very distinct in the hair of the belly and the head, and in the nails. For five days it was detected in each drop of the urine. Ten days afterwards the urine showed lithium very distinctly; only after thirty-two days was lithium absent from a few drops of the urine. The thirty-third day after the dose the animal was killed. No lithium was found in the bile, liver, blood, lens, kidneys, spleen, or other parts, by simply taking a small piece of the organ on a red-hot wire. The evaporated aqueous extract of the two lenses showed no trace of lithium; when, however, the two kidneys were incinerated, the ash treated with sulphuric acid, the resulting sulphates exhausted with absolute alcohol and the alcoholic extract evaporated to dryness, lithium was easily detected in the residue. A portion of the liver, treated in the same manner, also yielded lithium.

The second guinea-pig gave traces of lithium in the urine when one-eighth of an ounce was evaporated and treated with sulphuric acid and alcohol, thirty-nine days after the lithium was taken.

It follows from these experiments on the rate of passage of lithium into and out of the body, that—

With three grains of chloride of lithium, a young guinea-pig in half an hour had lithium in the watery extract of the lens. An old guinea-pig in the same time had no lithium in the lens.

With two grains, a young guinea-pig in six hours had lithium distinctly in all parts of the lens. An old guinea-pig had in the same time scarcely any lithium in the inner part, but some in the outer part of the lens.

With the same quantity, in six days neither a young nor an old guinea-pig gave any trace of lithium in the alcoholic extract of the kidney, liver, or lenses.

When two grains of chloride of lithium were taken, after six hours the lithium was more distinct in the outer than in the inner part of the lens. In twenty-four hours no difference in the different parts of the lens was detectable. In forty-eight hours still no difference was observed. In ninety-six hours (four days) no lithium was detectable in the lens or in a cartilage of a joint; still the urine showed lithium very distinctly even in one drop.

After one grain of chloride of lithium, in five hours and a half the lithium was more distinct in the outer than in the inner part of the lens. In twenty-four hours and a half there was no difference throughout the lens. In forty-eight hours the watery extract of the lens showed faint traces of lithium. In seventy-two hours and a half (three days) the alcoholic extract of the lens showed no lithium. The urine still showed lithium distinctly in one drop, and continued to do so for seventeen days in the alcoholic extract.

After a quarter of a grain, in five hours and thirty-five minutes lithium was distinct in the vitreous and aqueous humours, and very faintly in the lens. After sixteen days, the minutest traces of lithium were detected in the lens, the liver, and the kidneys, but no trace could be found in the blood. (This animal had perhaps somehow eaten the minutest quantity of lithia in the food*.)

After half a grain of chloride of lithium, in three hours and fifty minutes traces of lithium could be found in the lens, and for thirty-seven or thirty-eight days traces of lithium could be found in the urine.

After three grains of chloride of lithium, in four hours lithium was in the hair of the belly, and for thirty-two days the urine showed lithium very distinctly. The thirty-third day after the lithium the lens was found to contain minute traces of lithium, and after thirty-nine days the lithium was in the alcoholic extract of the urine.

4. *Experiments on the Rate of Passage of Lithium through the Human Body, and into and out of the Crystalline Lens.*

Experiment 1. A man took ten grains of carbonate of lithia dissolved in water, four hours after his midday food.

In five minutes no lithium could be detected in the urine.

In ten minutes lithium was evident.

In eighteen hours it was present in the nails of the hands and feet, and in the hair of the beard and body; apparently most where there was most perspiration. No lithium could be found in the hair of the head or whiskers.

In forty-two hours very perceptible.

In sixty-six hours another dose of ten grains was taken.

In ninety hours lithium was detectable in the hair of the head.

For three days after the second dose it was perceptible in one drop of the urine, but rather doubtful in the hair and in the nails.

For six days after the second dose lithium was detectable in the urine.

For eight days after, no lithium could be detected when the eighth of an ounce of urine was evaporated.

* The skin of guinea-pigs throws off lithium, and it collects on the hair and nails, so that it is possible for the animal to redose itself with lithium from its own body, and thus to keep lithium passing in and out of the textures much longer than if a single dose only were taken.

Twelve days afterwards, though no lithium was in the urine or the hair of the head or whiskers, it was detectable in the hair of the body.

Experiment 2. The same man three hours after breakfast took ten grains of carbonate of lithia.

In five minutes lithium was just perceptible in the urine.

In ten minutes extremely distinct in one drop of the urine.

In twenty-four hours very distinct in the urine.

Fourth day. Traces of lithium when the urine was concentrated by evaporation.

Fifth day. Less perceptible in evaporated residue.

Sixth day. No lithium could be detected in evaporated urine.

Experiment 3. The same man took ten grains of carbonate of lithia after fasting for seven hours. The urine was passed every second minute after taking the lithia.

Second, fourth, and sixth minute, no lithium.

Eighth minute, traces of lithium very slight.

Tenth minute, lithium distinctly present.

Third day afterwards lithium very distinct.

Fourth day. Lithium faintly found in each drop of urine.

Fifth day. Lithium very faint in each drop.

Sixth day. Only the merest trace.

Seventh day. No lithium in the eighth of an ounce evaporated to a few drops.

Eighteenth day. Two ounces of urine incinerated, and the ash heated with sulphuric acid and alcohol, showed no lithium.

Twenty-first day. Nails of the hands and feet still show lithium.

Experiment 4. The same man, two hours and a half after a little food, took ten grains of chloride of lithium: one nail on the hand and one on the foot were varnished before taking the lithium.

Second and fourth minute afterwards no lithium was in the urine.

Sixth minute, traces of lithium.

Eighth minute, distinctly present.

Tenth minute, very distinctly.

Twenty-five hours afterwards none of the nails showed any lithium.

Forty-four hours. Scrapings of the unvarnished nails on the hands and feet showed lithium distinctly. The further the scraping was carried the less lithium was found. The scrapings of the varnished nail of the hand shows only traces of lithium. The varnished nail of the foot has no lithium. A small particle of the skin from the hand or foot shows lithium distinctly. Perspiration shows lithium distinctly. The hair of the head or whiskers shows no lithium.

Third day. Nails the same as yesterday. The unvarnished nails show lithium; the varnished, none. Urine shows lithium most distinctly.

Fourth day. Urine shows lithium in one drop.

Fifth day. Urine still shows minute traces of lithium in one drop.

Sixth day. Urine shows no lithium. Ash of the urine shows faint traces of lithium.

Seventh day. Ash of urine shows no lithium. Alcoholic extract shows traces.

Eighth day. Alcoholic extract from one ounce of urine still shows traces of lithium.

Ninth day. Alcoholic extract from one ounce of urine shows no lithium.

Experiment 5. A boy, aged sixteen years, took five grains of chloride of lithium, and the urine was passed every second minute. Half an hour previously he had eaten some bread and butter. No lithium could be detected in the urine previous to the taking of the dose.

Second minute, no lithium in the urine.

Fifth minute, none.

Ninth minute, none.

Tenth minute, very faint traces of lithium.

Thirteenth minute, lithium very distinctly present.

After twenty-four hours lithium still very distinct.

Second, third, fourth, and fifth day. Still very distinct.

Seventh day. No lithium was found in the evaporated residue. The ash of the residue shows very slight traces.

Eighth day. The alcoholic extract from one ounce of urine shows no lithium.

Experiment 6. The same boy had his hair, nails, and urine examined, and no lithium was found.

Five grains of carbonate of lithia was then given to him.

In two minutes, five minutes, ten minutes, no lithium was found in the urine.

In twenty minutes lithium was distinctly present.

In eighteen hours the lithium was found in the nails, none in the hair of the head.

In thirty-two hours, still none in the hair of the head. Very distinctly in the root and tip of the nails.

Another five grains of carbonate of lithia was then given.

In nineteen hours lithium was detected in the hair of the head.

In four days a drop of the urine showed lithium very distinctly, as did the hair and nails.

In five days the same.

In seven days one drop of the urine shows no lithium, but if the urine is slightly concentrated by evaporation, lithium is still perceptible.

In eight days one-eighth of an ounce evaporated still shows slight traces.

In nine days no lithium in one-eighth of an ounce of urine.

Experiment 7. The same boy took five grains of carbonate of lithia, but he omitted previously to empty his bladder.

In five minutes, lithium not yet detectable in the urine.

In ten minutes lithium very distinctly present in one drop of the urine.

Four days afterwards traces of lithium still in the urine.

Five days afterwards slight traces in one-eighth of an ounce of urine when evaporated.

In six days afterwards no lithium perceptible in the urine.

Experiment 8. Twenty-five grains of chloride of lithium were dissolved in one gallon of water, and the feet and ankles of a man were kept in the solution for two hours; at the end of this time the urine was passed and examined for lithium, and no trace could be found in the aqueous extract of the ash of one quarter of an ounce of urine.

These experiments agree very closely with some which I made many years since on a full-grown German who had an open bladder, admitting the urine to be caught as it came from the kidneys.

Feb. 24, 1852. At 8.45 A.M. he took two cups of black coffee and nothing else.

9.30 to 9.50. Urine was caught, and it contained no trace of iron.

9.50. Protosulphate of iron, 6·7 grains, free from persulphate was taken in two ounces of distilled water.

9.55. Urine caught and contained no iron.

10. No iron as peroxide. Present as protoxide.

10.5. Slightest trace of peroxide. Protoxide distinct.

10.10. Slightest trace of peroxide. Protoxide distinct.

10.20. Slightest trace of peroxide. Protoxide less distinct.

10.30. ,, ,, Protoxide less distinct.

10.40. ,, ,, Slightest trace of protoxide.

11. ,, ,, No trace.

11.10. ,, ,, No trace.

Feb. 26. The same patient. At 8 A.M. two cups of black coffee and nothing else.

10.20 to 10.30. Urine caught and no trace of iron found.

10.30. Sulphate of protoxide of iron four grains, given in one ounce of distilled water.

10.31. No trace of iron in the urine.

10.34. No trace.

10.35. No trace.

10.36. No trace.

10.37. Slightest trace of protoxide of iron in the urine. No peroxide.

10.39. No trace.

10.40. No trace.

March 2nd. The same patient. At 8 A.M. two cups of black coffee and nothing else.

9.34 to 9.40. Urine collected and no trace of iron found.

9.40. Sulphate of protoxide given, seven grains in two ounces of distilled water.

9.42½. None.

9.45. None.
9.47½. None.
9.50½. A trace.
9.52½. A trace.
9.55. Good.
9.57½. Doubtful.
10. Doubtful.
10.5. More distinct.
10.10. Doubtful.
10.15. Doubtful.

March 19. At 8 A.M. two cups of black coffee without milk, nothing else taken.

Urine from 9.50 to 9.56 collected; contained no iodine. One grain of iodide of potassium dissolved in one ounce of water was then taken.

9·58. No iodine.
9.59. No iodine.
10. None.
10.1. None.
10.2. None.
10.3. None.
10·4. None.
10·5. None.
10.6. None.
10.8. Trace of iodine.
10.10. Very marked iodine.
10.15. Very marked.

So that one grain of iodide of potassium in one ounce of water was detected in the urine in twelve minutes, and was very marked in fourteen minutes. Iron was detected once in seven minutes and twice in ten minutes, and it was very distinct in fifteen minutes.

Professor Mulder also made many experiments on this patient, but I am unable to find any account of his results.

In the 'Medical Gazette' for 1845, pp. 363 & 410, Mr. Erichsen gives some experiments he made on a boy of thirteen who had an open bladder. He states that twenty grains of ferrocyanide of potassium were detected in one minute in the urine. The stomach was fasting, and the salt was dissolved in three ounces of water. Forty grains taken three quarters of an hour after a full meal were only detected after thirty-nine minutes.

Forty grains in four ounces of water were twice detected in two minutes, and no trace could be found after twenty-four hours; once in two minutes and a half; once in six minutes and a half; once in fourteen minutes; once in twenty-seven minutes; and once in thirty-nine minutes.

Twenty grains of ferrocyanide he once detected for twenty-eight hours.

It follows from these experiments that ten grains of carbonate or chloride of lithium, taken two and a half, three, or four hours after food by a man,

require between five and ten minutes to pass from the stomach to the urine, and this quantity of carbonate or chloride of lithium will continue to produce traces of lithium in the urine from six to seven, or even eight days.

Five grains of chloride or carbonate of lithia, taken shortly after food by a boy, gives no appearance in the urine until from ten to twenty minutes, and this quantity continues to pass out for five, seven, or eight days.

Experiments made by the ordinary mode of analysis showed that

Four grains of sulphate of the protoxide of iron, taken almost fasting by a man, gave a trace in the urine in seven minutes.

Seven grains gave distinct appearance in ten minutes and ten minutes and a half.

One grain of iodide of potassium, taken by the same man fasting, appeared in the urine in twelve minutes.

Experiments on the Rate of Passage of Lithium into and out of the Crystalline Lens.

Through the kindness of Mr. Bowman and Mr. Critchett at the Moorfields Ophthalmic Hospital, lithia water, containing variable quantities of lithia, was given to different patients about to be operated on for cataract.

Experiment 1. The hard cataracts from two patients who had taken no lithia water were examined; no trace of lithium could be found in either lens.

Experiment 2. The hard cataracts from two other patients who had no lithia water were examined; an aqueous extract of each lens was made; one showed the most excessively feeble lithium line; the other lens did not give the slightest indication.

Experiment 3. The hard cataracts of two other patients who had taken no lithia water were examined; the alcoholic extract of the ash, after treatment with sulphuric acid, showed no lithium in either lens.

The lens of a third patient was examined when no lithia water had been taken, and the alcoholic extract showed no lithium.

Experiment 4. The lens of a man aged seventy was extracted twenty-five minutes after he had taken twenty grains of carbonate of lithia in water on an empty stomach; no lithium could be detected in the lens.

Experiment 5. A woman, æt. sixty-four, at 9 A.M. took twenty grains of carbonate of lithia in water; both lenses were extracted at $11\frac{1}{2}$ A.M. the same day. Neither of the lenses showed any lithium when touched with a red-hot wire, but the aqueous extract of one lens showed lithium faintly, and the aqueous extract of the other lens showed lithium distinctly.

Experiment 6. An eye was removed three hours after twenty grains of carbonate of lithia had been taken; the lens was removed half an hour afterwards, and on examination every portion of the lens contained lithium. The circulation through the eye had been healthy, and the lens itself was clear.

Experiment 7. The soft lens of a girl aged fourteen was examined after

ten grains of carbonate of lithia in water had been taken five hours before the operation, and the same quantity four hours before extraction.

The smallest fraction of the lens showed the lithium distinctly.

Experiment 8. Another patient with two soft cataracts took twenty grains of carbonate of lithia seven hours before one operation; but the capsule of the lens had been previously broken, so as to expose the cataract to the aqueous humour.

Lithium was found very distinctly even in the smallest particle of the cataract.

Four days after the first operation the capsule of the other lens was broken, so as to expose the cataract to the aqueous humour; and seven days after the first operation the second operation was performed.

In this cataract not the slightest trace of lithium could be found.

A woman with diseased heart drank some lithia water, containing fifteen grains of citrate of lithia, thirty-six hours before her death; and six hours before death she drank the same quantity.

After death the crystalline lens, the blood, and the cartilage of one joint were examined for lithium.

The cartilage showed lithium very distinctly; the blood showed lithium very faintly; and when the entire lens was taken for a single examination, the faintest possible indications of lithium were obtained.

Another patient five and a half hours before death drank lithia water containing ten grains of carbonate of lithia.

After death the cartilage of one joint and the crystalline lens were examined.

The cartilage showed lithium very distinctly. When half the lens was taken for a single analysis, only very faint traces of lithium could be found.

When no lithia had been taken, seven cataracts were examined most carefully, and one only showed an exceedingly feeble trace of lithium.

When twenty grains of carbonate of lithia were taken twenty-five minutes before the operation, the lens showed no lithium; the same quantity taken two and a half hours before, showed lithium in the watery extract; three and a half hours before, showed lithium in each particle; between four and five hours before, the same; seven hours before, the same; seven days before, not the slightest trace of lithium.

Thirty grains of carbonate of lithia, taken between six and thirty-six hours before death, showed the faintest indications of lithium in the lens.

Ten grains of carbonate of lithia taken five and a half hours before death, gave only faint traces of lithium in the lens.

On the Passage of Solutions of Lithium through the Textures after death.

A sheep's eye was examined after death and no lithium could be detected in any part. Two other eyes were placed in a solution of chloride of lithium containing one grain to one litre of water. Twenty-three hours afterwards the lithium was found to have penetrated through the entire

eye. There was, however, a perceptible difference between the amount of lithium in the inner and outer part of the lenses.

Two other sheep's eyes had a small portion of the cornea in front and the sclerotic removed at the back; they were then placed in a moderately strong solution of chloride of lithium, and the aqueous humour was examined from time to time.

After eighteen hours the aqueous humour showed lithium distinctly, and when the lens was extracted the lithium was found throughout its substance.

Two other eyes were placed whole in a solution containing one-tenth of a grain of chloride of lithium to one litre of water.

In twenty-four hours the lithium had penetrated the entire eye. No difference was perceptible in different parts of the lens.

The rate at which a solution of chloride of lithium diffused through the stomach of a fresh-killed guinea-pig which had taken no lithium was determined.

A solution of one grain of chloride of lithium in twenty grains of water was put into the stomach, and it was hung up so that the solution gravitated to the lowest part. The outer side of the stomach opposite the solution was touched from time to time with a loop of platinum wire, which was afterwards tested for lithium.

In first minute. No lithium came through the stomach.
In second minute. No lithium.
In third minute. No lithium.
In fourth minute. No lithium.
In fifth minute. No lithium.
In sixth minute. Traces of lithium.
In seventh minute. Traces of lithium.
In eighth minute. Lithium was very distinct.

The stomach of another guinea-pig was filled with a solution of lithium containing one grain of lithium in about half an ounce of water. The stomach was entirely filled and laid flat on a plate. The ends of the stomach and round the side showed lithium coming through in four minutes. The upper part of the stomach showed the lithium coming through in fifteen minutes.

5. *On the Presence of Lithium in Solid and Liquid Food.*

An ounce of each substance was taken. It was dried or evaporated, and incinerated carefully at a low red heat in a muffle on a platinum tray. The ash was tested for lithium first by taking a small fraction on a loop of a platinum wire into the flame of the spectroscope. When no lithium was thus detected, the ash was treated with sulphuric acid, and heated to expel the excess of acid; the dry residue was extracted with absolute alcohol, the solution filtered, evaporated to dryness, and the residue taken up in a drop of water and tested by the spectroscope.

Potatoes.	In ash direct.	In alcoholic extract.
No. 1.	No lithium.	No lithium.
2.	,,	,,
3.	,,	,,
4.	,,	Lithium distinctly.
5.	,,	No lithium.
Apples.		
No. 1.	,,	,,
2.	,,	,,
3.	,,	Lithium distinctly.
4.	,,	Trace of lithium.
Carrots.		
No. 1.	,,	No lithium.
2.	,,	,,
Bread.		
No. 1.	,,	Slight traces of lithium.
2.	,,	Traces of lithium.
3.	,,	Lithium distinctly.
Savoy Cabbage.		
No. 1.	Lithium distinctly.	
2.	No lithium.	Lithium shown distinctly.
Tea.		
No. 1.	,,	,,
2.	,,	Lithium very faintly.
3.	,,	Lithium very distinctly.
4.	,,	Faintly.
5.	,,	,,
6.	,,	,,
7.	,,	No lithium.
8.	,,	Faintly.
9.	,,	No lithium.
10.	,,	Very distinctly.
Coffee.		
No. 1.	,,	Very faintly.
2.	,,	,,
3.	,,	No lithium.
4.	,,	Lithium distinctly.
5.	,,	Very distinctly.

Wines: in almost all cases the ash gave direct evidence of the presence of lithium.

Port Wines.		
No. 1.	Small traces of lithium.	
2.	Faintly.	
3.	Very faintly.	Lithium exceedingly distinct.

Port wines.	In ash direct.	In alcoholic extract.
4.	Very faintly.	Lithium exceedingly distinct.
5.	No lithium.	Very faintly.
6.	,,	Very distinctly.

Sherry.

No. 1.	Lithium extremely brightly.
2.	Faintly.
3.	Exceedingly faintly.
4.	Very faintly.
5.	Faintly.
6.	Distinctly.

French Wines.

No. 1. (red).	Lithium very distinctly.
2. (white).	Extremely distinctly.
3. (champagne).	Very brightly.
4. (,,).	,,

Rhine Wines.

No. 1.	Lithium exceedingly faintly.
2.	,,
3.	Lithium distinctly.
4.	Very faintly.
5.	Distinctly.
6.	Faintly.
7.	Distinctly.
8.	Faintly.

Ale.

No. 1.	No lithium.	Lithium faintly.
2.	,,	No lithium.
3.	,,	Lithium faintly.

Porter.

No. 1.	,,	,,
2.	,,	No lithium.
3.	,,	Lithium distinctly.

In the Philosophical Magazine, vol. xx. Messrs. A. and F. Dupré gave the spectrum analysis of London waters. All the different waters examined gave lithium. The shallow waters appear to be richer in lithium than the deep-well waters. The different waters examined were: Thames water at high and low tide at Westminster Bridge; the water from Chelsea and Lambeth Water-Companies; New River water; Duck Island well, in St. James's Park; Pump in Lincoln's-Inn. These were above the London clay.

Burnett's Distillery and Whitbread's Brewery: from the sand above the Chalk.

Guy's Hospital well and Trafalgar Square well: from the Chalk.

	In ash direct.	In alcoholic extract.
Entire sheep's kidney.	No lithium.	Very faint traces.
One ounce of kidney.	,,	No lithium.
One ounce of mutton.	,,	,,
One ounce of beef.	,,	,,

It appears from these experiments that

Potatoes	showed lithium	once in five trials.
Apples	,, ,,	twice in four trials.
Carrots	,,	no lithium in two trials.
Bread	,,	lithium thrice in three trials.
Cabbage	,, ,,	twice in two trials.
Tea	,, ,,	eight times in ten trials.
Coffee	,, ,,	four times in five trials.
Port wine	,, ,,	six times in six trials.
Sherry	,, ,,	six times in six trials.
French wine,	,,	four times in four trials.
Rhine wine,	,, ,,	eight times in eight trials.
Ale	,, ,,	twice in three trials (traces).
Porter	,, ,,	twice in three trials (traces).

Mutton, beef, and sheep's kidney showed no lithium: one kidney had a slight trace of lithium.

I hope in a future paper, with the help of Dr. Dupré, to show that Thallium, Rubidium, and Cæsium, by spectrum analysis, can be traced even into the crystalline lens, and to determine the rate at which they pass in, if not out of, the textures; and by other means we shall endeavour to trace the passage of other crystalloids throughout the textures.

Conclusions.

1. *On the Rate of Passage of Solutions of Lithium into the Textures of Animals.*

In guinea-pigs, even in a quarter of an hour after three grains of chloride of lithium are taken into the stomach, the lithium may be found not only in all the vascular textures, but even in the cartilage of the hip-joint, and in the humours of the eye. If the same quantity is injected into the skin, in ten minutes it can be detected in the lens and everywhere; and even in four minutes the lithium may be detected everywhere except in the lens.

In half an hour after the same quantity is taken into the stomach, lithium may be found in the crystalline lens.

After it has been taken eight hours, it may not have passed completely into the inner part of the lens.

In twenty-six hours it will be found in every part of the lens.

When half a grain only of chloride of lithium was taken, in less than

four hours traces were found in the lens. And even when only a quarter of a grain was taken, faint traces of lithium were found in five and a half hours.

2. *On the Rate of Passage of Solutions of Lithium out of the Textures of Animals.*

After two grains of chloride of lithium, in six days neither a young nor an old guinea-pig gave any lithium in the kidney, liver, or lenses.

After two grains, in four days no lithium could be found in the lens, nor in the cartilage of a joint.

After one grain, in three days the alcoholic extract of the lens showed no lithium.

After a quarter of a grain of chloride of lithium, in sixteen days the minutest traces of lithium were detected in the liver, kidneys, and lens.

After half a grain, for thirty-seven or thirty-eight days traces of lithium could be found in the urine.

After three grains, traces were found in the lens for thirty-three days, and for thirty-nine days, the smallest quantity could be found in urine.

The skin of guinea-pigs throws off lithium, and it collects on the hair and nails; so that it is possible for the animal to redose itself with lithia from its own body, and thus to keep lithia passing in and out of the textures much longer than if a single dose only were taken.

3. *On the Rate of Passage of Solutions of Lithium in and out of the Human Body.*

In ten-grain doses, lithium may be found in the urine in from five to ten minutes, and continue to pass out for six or seven days.

In five-grain doses it may be in the urine in from ten to twenty minutes, and continue to pass out even for eight days.

In twenty-grain doses, it may be found in small quantity in the crystalline lens in two and a half hours, and be present in every particle of the lens in three and a half, five, and seven hours; and no trace of lithium may be detectable in the lens after seven days, when twenty grains of the carbonate of lithia had been taken.

4. *Results of the examination of Solid and Liquid Food.*

Although almost every kind of vegetable food, and almost every fluid which we drink, contains infinitesimal quantities of lithia, yet rarely, if ever, can lithium be detected in any part of the body of man or animals, unless some larger quantity is taken than ordinarily occurs in the food or drink.

Appendix.—Received July 8, 1865.

On the Passage of Chloride of Rubidium into the Textures.

A guinea-pig was given three grains of chloride of rubidium at 11 A.M.

At 6.30 P.M it was killed. Rubidium was not detectable anywhere; not even satisfactorily in the urine.

Another guinea-pig was given ten grains of chloride of rubidium at 11.20 A.M. At 3 P.M. scarcely any rubidium could be detected in the urine. The following day, at 11 A.M., it was given five grains more. At 2 P.M. rubidium was just detectable in the urine. The next day, at 2 P.M., it was again given five grains, the rubidium being just perceptible in the urine. Twenty-five hours afterwards it was killed.

Extremely minute traces of rubidium were found in the kidney and in the blood; somewhat more, but still very faint traces, in the liver. In the cartilages no rubidium could be found, nor in the aqueous humour of the eye. When the whole lens was incinerated at once the smallest possible trace of rubidium was found. The urine showed traces of rubidium.

An elderly man took nineteen grains of chloride of rubidium four hours before he was operated on for cataract. The most careful search could not find any rubidium in the lens after its removal.

Another patient, with a double cataract, was given twenty grains of chloride of rubidium. One lens was extracted ten hours afterwards, and the other seven days afterwards, but in neither could traces of rubidium be found.

It was found by experiment that $\frac{1}{16,000}$ of a grain of chloride of rubidium in water was detectable by the spectrum analysis. $\frac{1}{8000}$ of a grain in urine could be distinctly observed.

On the Passage of Chloride of Cæsium into the Textures.

Delicacy of the reaction for Cæsium.—One grain of chloride of cæsium in 400 cub. centims. of water just gives the blue cæsium lines in a quantity of solution that can adhere to the loop of a platinum wire which took up 0·05 of solution. The $\frac{1}{125,000}$ part of a grain of chloride of cæsium in water can be detected. If potassium is present in the same solution the test is much less delicate.

In urine, one grain of chloride of cæsium in 200 cub. centims. is the limit of the reaction for a quantity remaining on the loop of the same wire as was previously used. Hence $\frac{1}{62,500}$ of a grain of chloride of cæsium in urine can be detected.

A guinea-pig was given three grains of chloride of cæsium, and twenty hours afterwards another three grains. Twenty hours after the second quantity it was killed. The ash of the urine showed cæsium slightly. No cæsium could be detected in the two lenses taken for one examination; nor in the liquid humours of the eyes. A small portion of the ash of the kidneys and liver showed no cæsium, but aqueous extracts, after concentration, showed cæsium faintly. No cæsium could be detected in the blood, nor in the bile.

A guinea-pig was given six grains of chloride of cæsium, and six grains more nineteen hours afterwards; twenty-four hours after the second dose

it was killed. No cæsium could be found in the lenses, nerves, aqueous humour, blood, or bile. Urine, kidney, and liver showed cæsium slightly in the aqueous extract of the ash.

A guinea-pig was given ten grains of chloride of cæsium, and twenty hours afterwards ten grains more. Twenty-seven hours after the second dose it was killed.

The evaporated and incinerated extract of the two lenses showed the cæsium only faintly. The aqueous humour of the eye showed cæsium faintly. The evaporated and incinerated extract of the two large nerves of the legs showed cæsium pretty distinctly.

On the Passage of Sulphate of Thallium into the Textures.

A rabbit was given one grain of sulphate of thallium. The urine, passed two hours after the first dose, gave the reaction very clearly.

Another rabbit was given three grains of sulphate of thallium, and it was killed twenty-one hours and a half afterwards. This rabbit took no food after the dose of thallium, but the stomach was found completely full of dry food. Thallium was found in the kidneys, liver, and spleen, by simply touching with a red-hot wire and bringing the small quantity of substance adhering to the wire into the flame. The blood, lens, and cartilage showed none in this manner. The aqueous extract, however, of the coagulated blood and lens showed thallium distinctly. The cartilage of the hip could not be thus examined, owing to the small quantity to be got.

Another rabbit was given three grains of sulphate of thallium, and it was killed in six hours and a half. The aqueous extract of the lens showed thallium distinctly.

A guinea-pig was given two grains of sulphate of thallium, and twenty hours afterwards it took two grains more; twenty-two hours after the second dose it was killed. The urine showed thallium only after concentration. Small pieces of the liver, kidney, cartilage of the short ribs, and large nerve of the leg showed thallium distinctly. Humours of the eye showed thallium distinctly. Aqueous extract of the lenses together showed it distinctly. The blood showed no thallium directly, but the aqueous extract of a small quantity of coagulated blood showed the thallium very faintly. The brain showed the thallium also very faintly. The toe-nails showed the thallium very distinctly; and the hair of the belly also showed it very distinctly.

Another guinea-pig was given two grains of sulphate of thallium, and it was killed in six hours. The aqueous extract of the lens showed thallium faintly. The urine showed the thallium distinctly. The aqueous extract of the two large nerves showed no thallium.

On the Passage of Sulphate of Silver into the Textures.

A guinea-pig was given one-eighth of a grain of sulphate of silver. Twenty-three hours afterwards it was given another eighth of a grain.

Twenty-seven hours afterwards a third eighth of a grain was given; and the same dose on the third, fourth, fifth, sixth, seventh, ninth, and tenth days; on the eleventh day the animal died. One grain and a quarter of sulphate of silver in twelve days was taken. The ashes of the liver, kidney, and stomach showed silver fairly, by means of galvanic precipitation of silver or copper. The ash of the bile showed silver rather less distinctly. The ash of the urine showed the silver only very slightly. The ash of the lenses showed only very slight traces of silver, and the ash of the brain showed none.

On the Passage of Chloride of Strontium into the Textures.

Two guinea-pigs, which had been given no strontium, had the whole kidney, liver, and lenses examined for strontium, but no trace of it could be found.

A guinea-pig was given four grains of chloride of strontium; in seven hours it was killed. The urine showed strontium distinctly in a single drop. No strontium could be detected in the kidney, liver, or lens, though a whole lens was taken for the examination by the spectrum analysis.

Another guinea-pig was given ten grains of chloride of strontium; in fourteen hours and a half it was killed. A small quantity of urine showed no strontium, and no strontium was found in the ashes of the kidney or liver.

To a third guinea-pig half a grain of chloride of strontium was given. Nineteen hours afterwards the urine showed traces of strontium, and then half a grain more was given. Twenty-four hours and a half afterwards another grain was given; and twenty-four hours after this half a grain more. Twenty-seven hours afterwards another half grain of chloride of strontium was given. At this time then the urine showed strontium very distinctly. On the sixth day another half grain, and again on the seventh, eighth, ninth, tenth, and eleventh day, until five grains and a half were taken. The twelfth day it was killed. The urine showed strontium distinctly. No strontium could be detected in the lens, humours, or blood; and minute traces only in the ash of the kidneys and liver.